

Innovation Center for U.S. Dairy

U.S. Dairy Industry's Report
National Market Value of
Anaerobic
Digester Products

2013 AgSTAR National Conference

National research team

Informa Economics

- Leader in agricultural commodities
- Defined revenue potentials for digester products



Center for Advanced Energy Studies

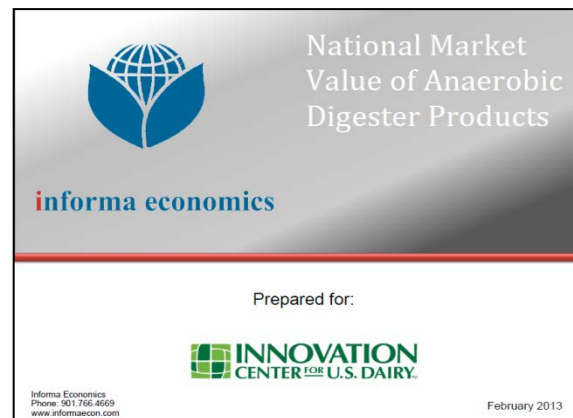
- Idaho Universities and DoE Idaho National Laboratory
- MOU with IC for joint dairy industry research
- Technical support for the report and economic models



Overview

Report frames opportunities for dairies, food processors and retailers to create a \$2.9 billion bioeconomy for food and agriculture while addressing current environmental concerns:

- *Food waste repurposing*
- *Nutrient harvesting*
- *Environmental quality*



www.USDairy.com

Google: National Market Value of Anaerobic Digester Products

U.S. Dairy National Market Value of Anaerobic Digester Products

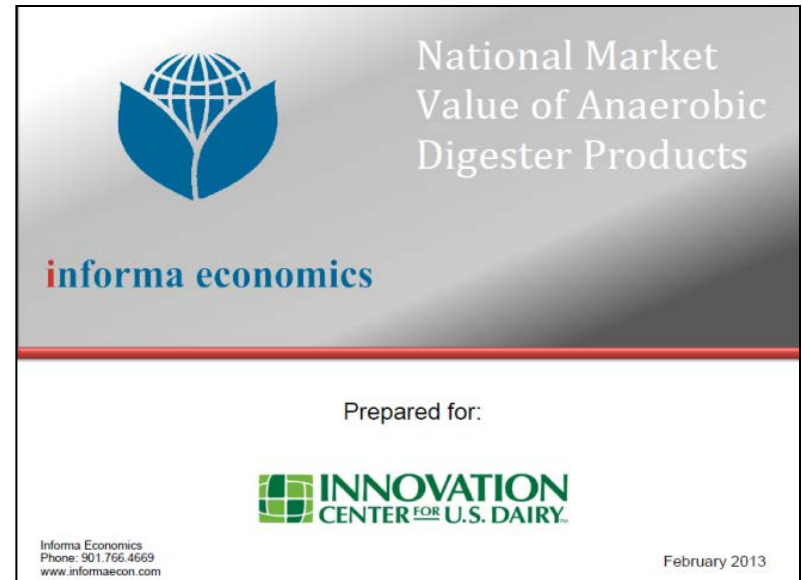
The Opportunity

- ❑ *\$2.9 billion NPV*
- ❑ *2,647 dairy digesters*
- ❑ *4 million cows*
- ❑ *9 million tons/yr. manure*

The New Drivers

- ❑ *Food waste repurposing*
- ❑ *Nutrient harvesting technology*
- ❑ *Soil Amendments (N, P, Fiber)*
- ❑ *Monetization of Environmental Value*

*Findings from National Market Value
Project Conducted by Informa Economics*



Dairy digester: a new model that can result in a \$2.9 billion industry

Old Model

Inputs



Manure
109 Mil Tons

**Initial
Technology**

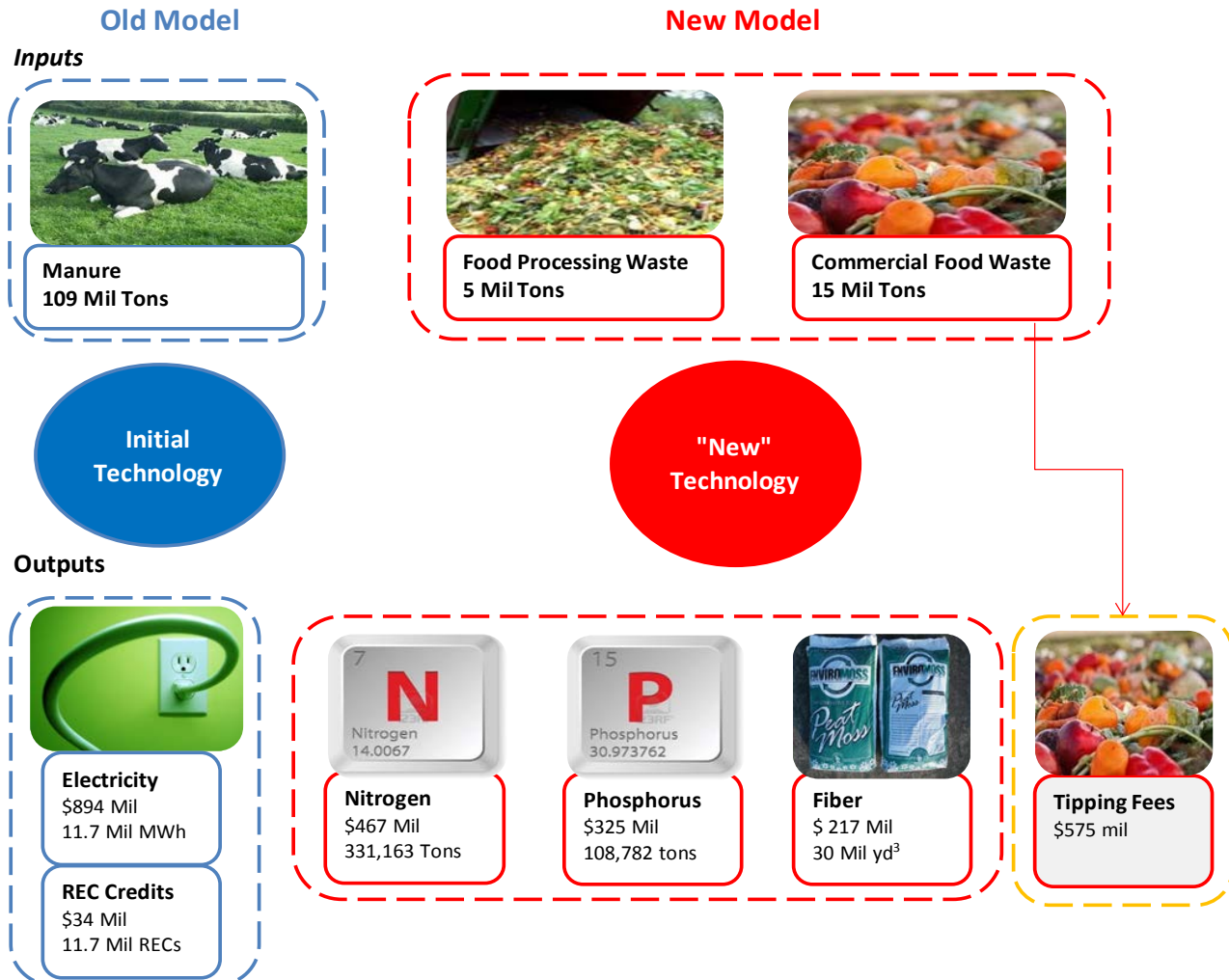
Outputs



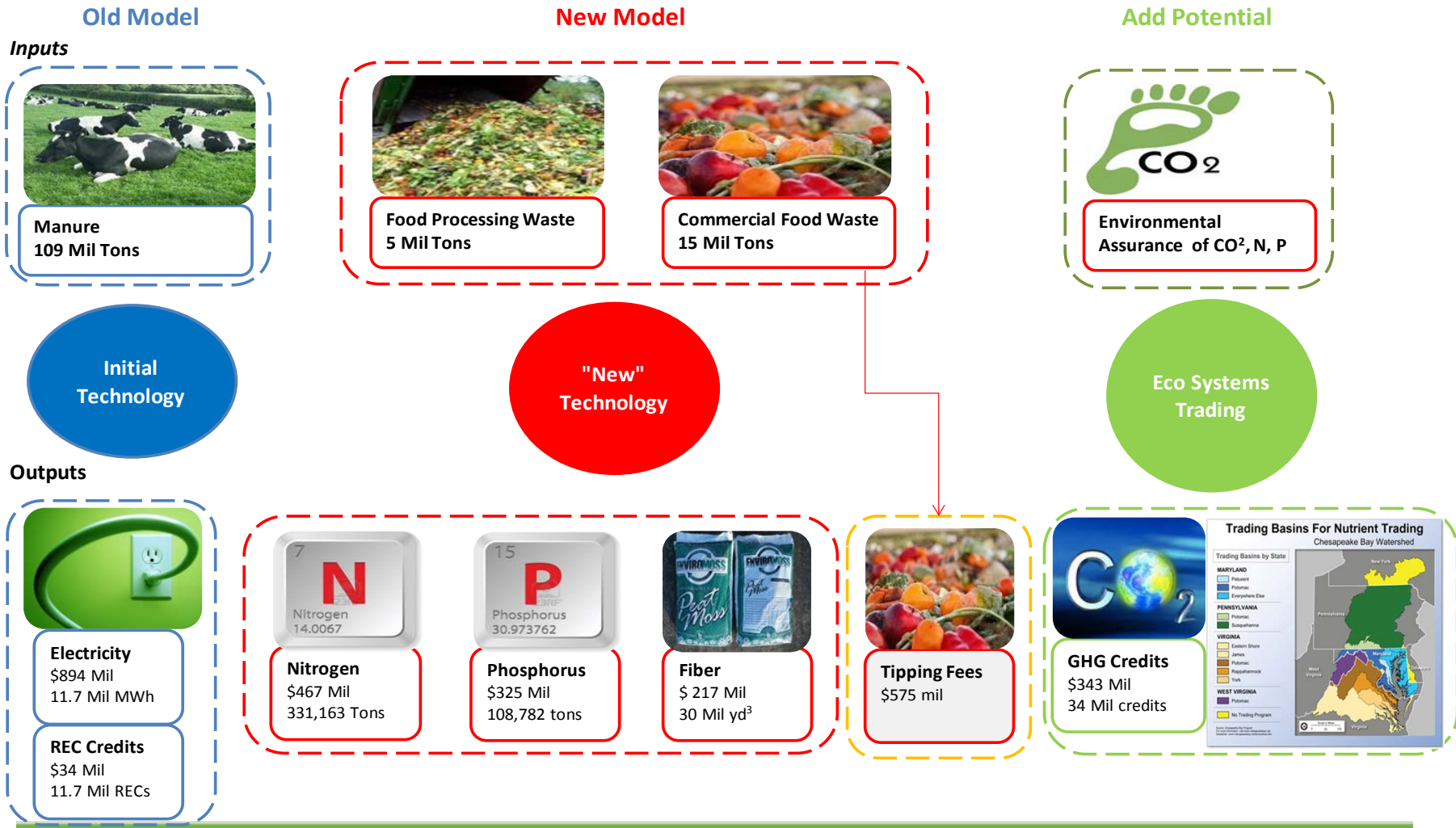
Electricity
\$894 Mil
11.7 Mil MWh

REC Credits
\$34 Mil
11.7 Mil RECs

Dairy digester: a new model that can result in a \$2.9 billion industry



Dairy digester: a new model that can result in a \$2.9 billion industry



Nutrients, fiber, eco credits and tipping fees drive the new digester model

**Electricity &
RECs
\$228 per Cow
per Year**



**Nutrients
and Fiber
\$255 per
Cow per Year**



**Tipping Fees & GHG
Offset Credits
\$232 per Cow per
Year**

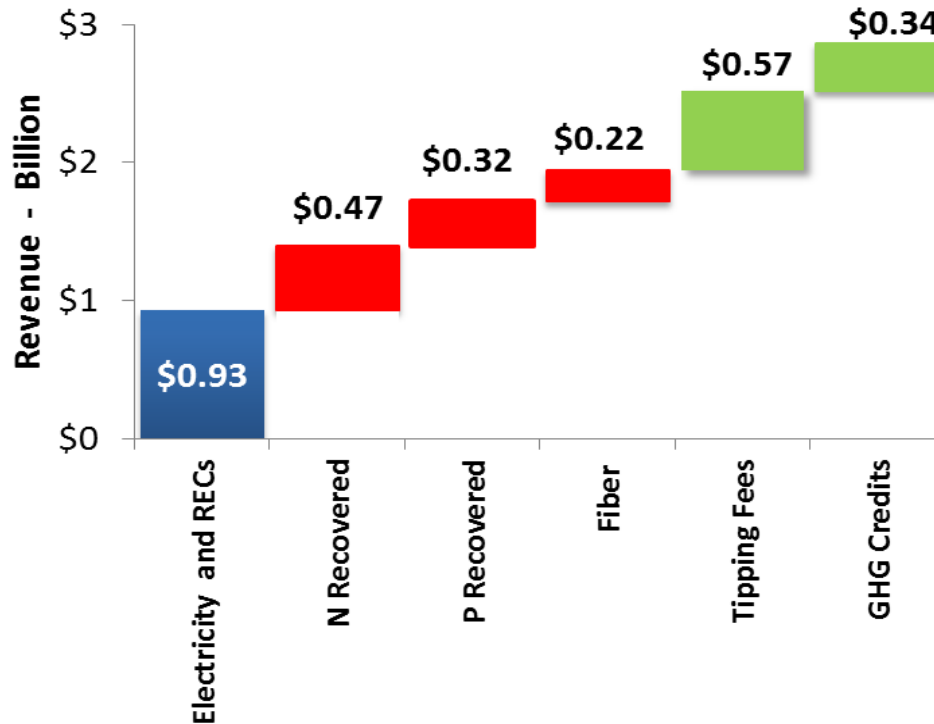


Selected co-product NPV assumptions for study scenarios

	Low Valuation	Mid Valuation	High Valuation
Recovered Nitrogen (\$/ton)	941	1,411	2,822
Recovered Phosphorous (\$/ton)	1,492	2,984	3,730
All Fiber (\$/cubic yard)	6.00	7.21	7.68
CO2 Offset Credits (\$/MT CO2 Equiv.)	1.00	10.00	25.00
Electricity (\$/kWh)	0.030	0.076	0.110

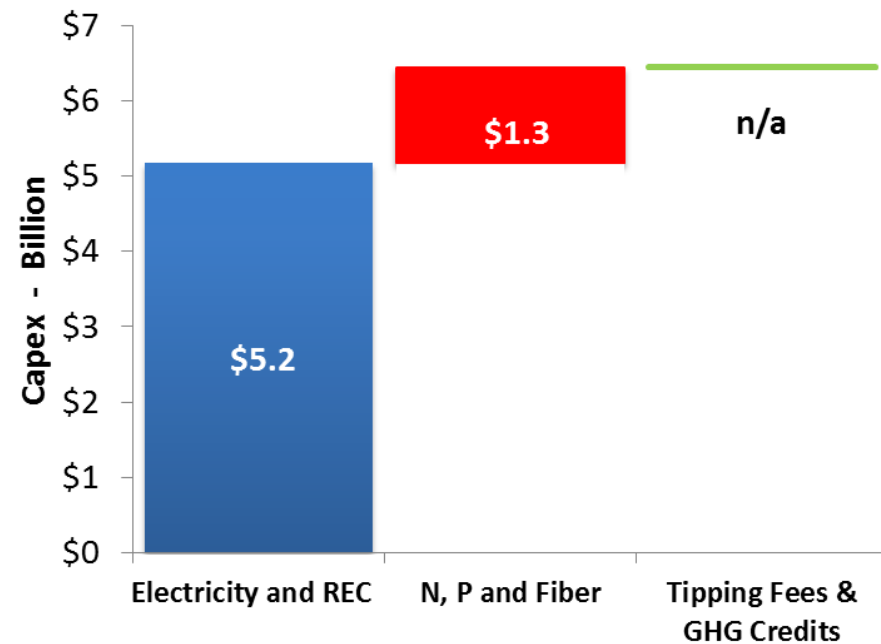
- ☐ Mid valuation price levels most likely
- ☐ Fiber - average price for bedding, field application and peat moss
- ☐ Nitrogen and phosphorous reflect historical price volatility
- ☐ Electricity prices depend on utility avoided costs and state regulations
- ☐ CO₂ offset price based on long-term price estimates

Revenue structure and Capex required to build 2,647 dairy digesters



\$2.9 billion of annual output from 2,647 digesters throughout the U.S.

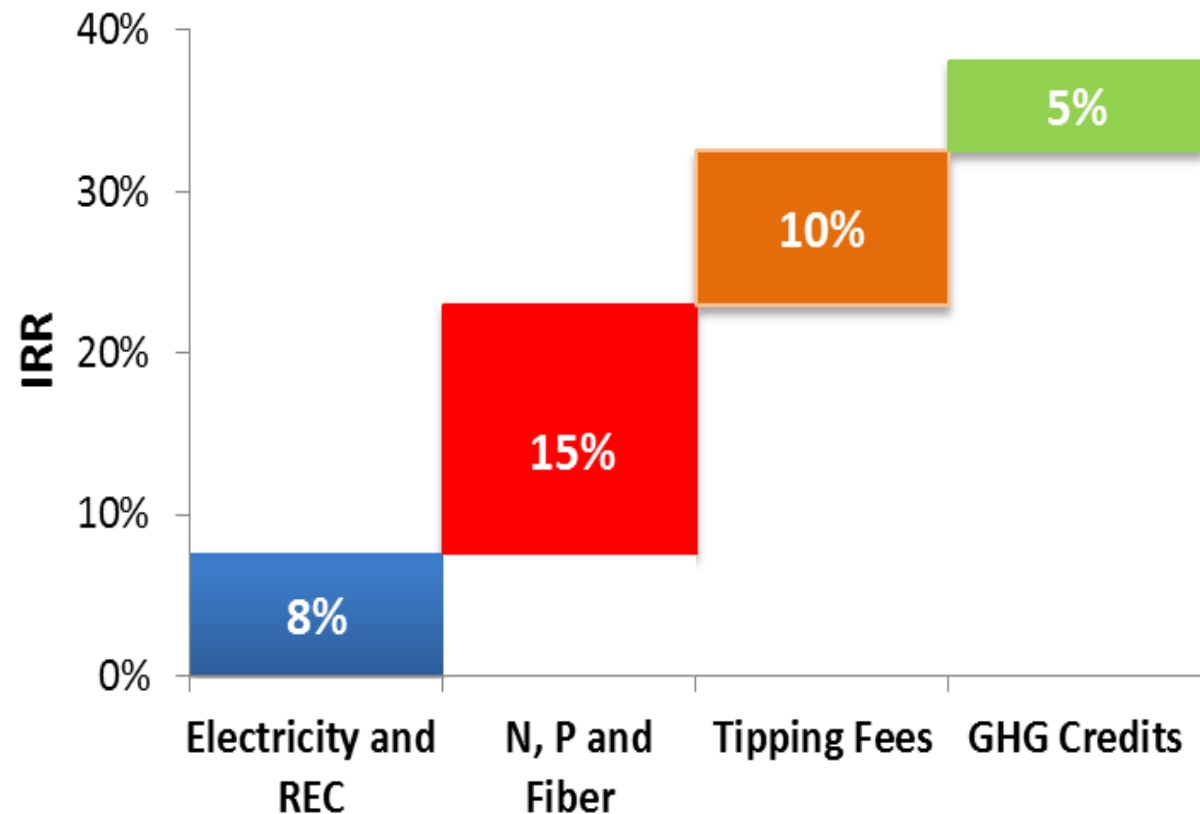
\$6.5 billion of investment on capital expenditures to realize full value.



Investment in recovered nutrients and fiber significantly improves IRR

Mid valuation scenario shows:

- Nutrient and fiber recovery has a large IRR impact.
- IRR can grow to very attractive levels (38%) if environmental value is monetized.



Eco System benefits from dairy digesters



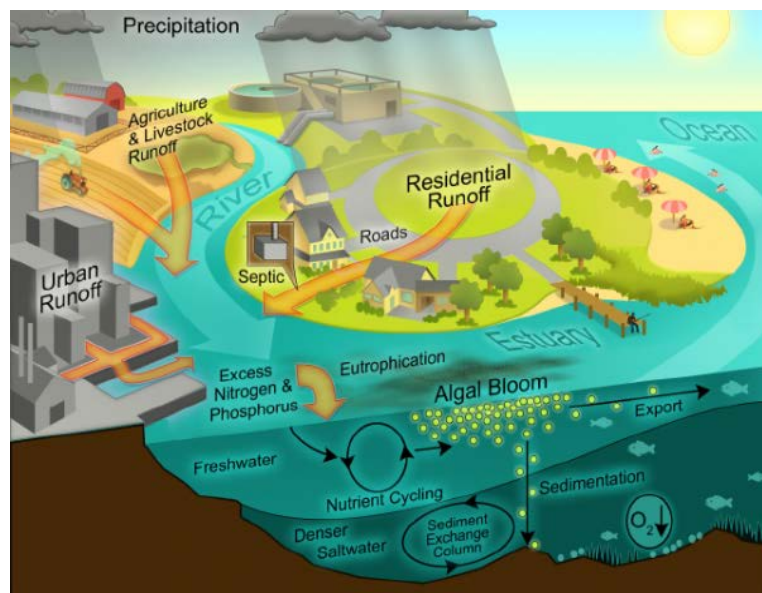
**109 M tons dairy
cow manure**

**9% reduction of
agriculture
methane emissions**

**8% of landfill
waste goes to
digesters**



**Equivalent to 13 MMT of CO2
not emitted into air
taking 3.2 million cars off the road**



**Reduces
Agricultural
Nutrient
Runoff in
Waterways**

**Replaces
Nitrogen
Fertilizer
Production of
331,163 tons**

**Replaces
Phosphorus
Fertilizer
Production of
108,782 tons**

Today, one out of three food calories is wasted

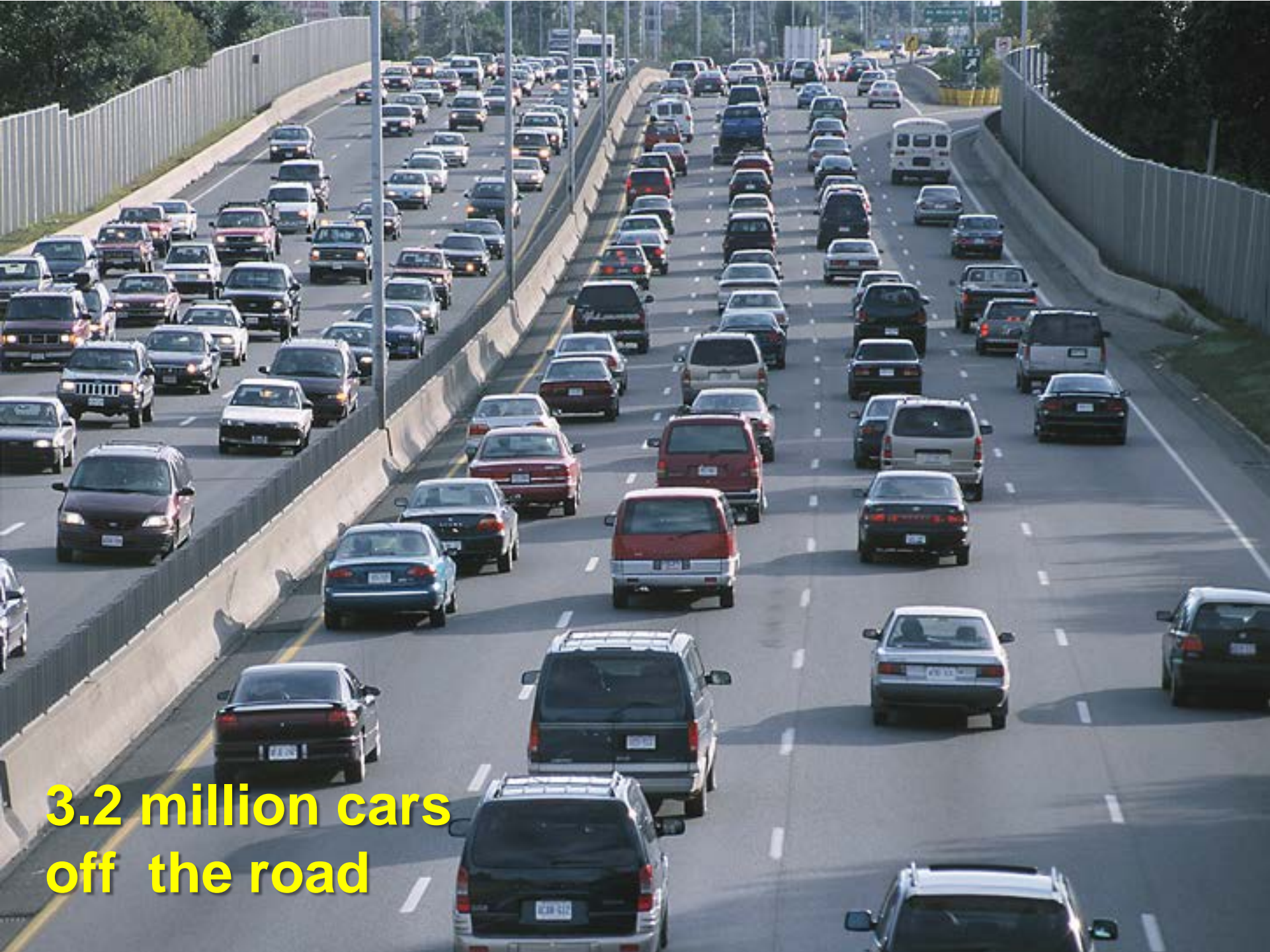




More Phosphorus fertilizer than needed for annual
U.S. tomato production

Nitrogen
fertilizer for
4.9% of U.S.
corn
production





**3.2 million cars
off the road**

**Supply 1 million
homes with electricity**

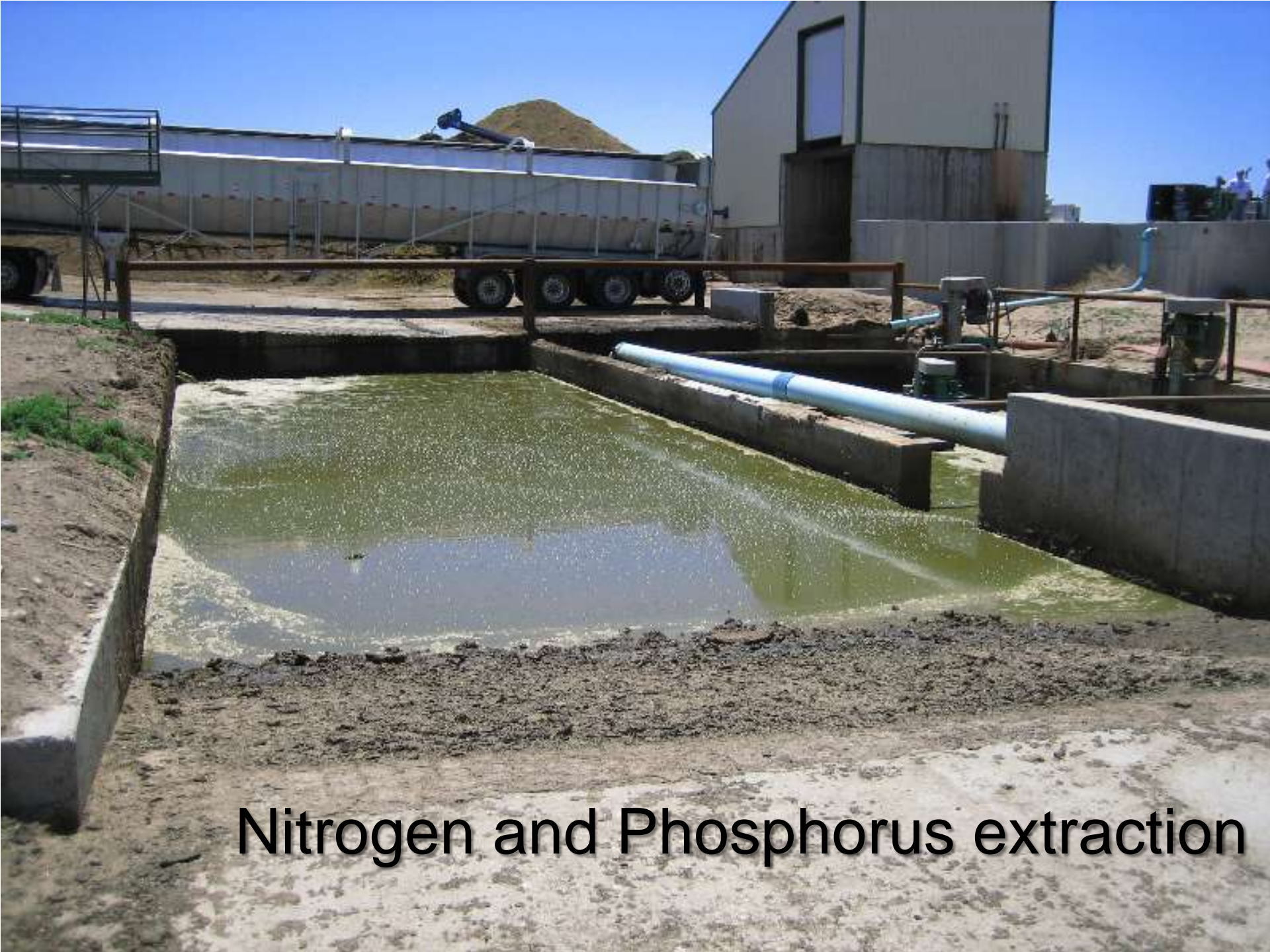


**813 million
bags of nutrient
rich potting soil**



A close-up photograph showing a person's hand holding a small, clumpy mass of brown, fibrous material. The background is a large, textured pile of the same material, which appears to be a byproduct of a biological process like composting or fermentation. The lighting is bright, casting a shadow of the hand onto a light-colored surface at the bottom left. The text "Pathogen free fiber" is overlaid on the right side of the image.

Pathogen free
fiber



Nitrogen and Phosphorus extraction

What needs to happen to develop the industry?

- ❑ Skills and expertise to:
 - ✓ Operate digester efficiently
 - ✓ Negotiate organic waste feedstock procurement
 - ✓ Market energy, fertilizers, fiber and energy/eco credits
- ❑ Co-product (N, P, fiber) market development
- ❑ Procurement of organic waste; location is key
- ❑ Monetization of environmental credits/benefits
- ❑ Need a business structure that:
 - ✓ Ensures a “balanced” return and risk to dairy farmers, investors & developers
- ❑ Intensive use of nutrient separation digester technology

Transformational partnerships: dairies, retailers and partners

